Rev. Brasil. Genet. 16, 3, 825-828 (1993)
(Brazil. J. Genetics)

SHORT COMMUNICATION

ESTIMATES OF SIRE OF FETUS EFFECTS ON PRODUCTION TRAITS OF PITANGUEIRAS COWS

João Francisco Pereira Bastos[1], José de Carvalho Reis[2] and Raysildo Barbosa Lôbo[3]

ABSTRACT

2,287 records of milk yield (MY), fat yield (FY) and fat percentage (F%) of 618 Pitangueiras cows (3/8 Zebu, 5/8 Red Poll), daughters of 82 sires (SOC), mated with 68 sires of fetus (SOF) were analysed to estimate the magnitude of sire of fetus effects on the productive traits. Statistical analysis were made with least-squares procedures, proposed by Harvey (User's guide for LSMLMW, Wooster, Ohio State University, 1987). The SOF effects estimates, expressed as a percentage of total variance, were 0.81, 1.67 and 6.43 for MY, FY and F%, respectively. These results suggest that inclusion of sire of fetus effects in the analysis can improve the results of progeny tests and the estimates of breeding values of tested sires.

INTRODUCTION

In 1915, Gaines hypothesized that the sire of the fetus (SOF) could affect milk yield of the dam, through the fetus. Nevertheless, only in the middle seventies was the first paper supported by statistical analysis published (Skejervold and Fimland, 1975). Since that publication, many researchers have confirmed this effect, estimated to be

[1] Departamento de Biologia, Faculdade de Engenharia de Ilha Solteira, 15378-000 Ilha Solteira, SP, Brasil. Send correspondence to J.F.P.B.

[2] Departamento de Zootecnia, Universidade Federal Rural do Pernambuco, 51000-000, Recife, PE, Brasil.

[3] Departamento de Genética, Faculdade de Medicina de Ribeirão Preto, USP, 14049-900 Ribeirão Preto, SP, Brasil.

between one and 10% of total variance for milk yield (MY) and fat percentage (F%). (Thatcher *et al.*, 1979; Balaine and Touchberry, 1980; Hayes *et al.*, 1984; Moya, 1985; Lôbo *et al.*, 1990; Moya *et al*, 1991).

The conceptus (fetus + placenta) is genetically different from the dam's genotype. It is capable of many interactions with the mother through the endocrine system (Wilcox, 1980). The hormonal production of the conceptus allows for fetal development and regulation of maternal functions to insure conditions for continuous growth, maturation and delivery. The fetus stimulates, directly or indirectly, the endocrine system of the dam, and is responsible for the mammogenesis, lactogenesis and galactopoiesis of the mammary gland (Bolander *et al.*, 1976; Eley *et al.*, 1978).

According to the genetic model proposed by Skejervold and Fimland (1975), the phenotype for milk production (P_D) can be defined as $P_D = \mu + 0.5\ G_{SOF} + 0.5\ G_{SOC} + R$, where: μ = overall mean; G_{SOF} = genotype of sire of fetus; G_{SOC} = genotype of sire of cow and R = error.

We evaluated and quantified the SOF effects on MY, FY and F%.

MATERIAL AND METHODS

The data file included 2,287 lactations of 618 Pitangueiras cows, daughters of 82 sires (SOC), and mated to 68 bulls (sires of fetuses, SOF). The herd belong to the Companhia de Financiamento Mercantil (CFM), located at Pitangueiras, S.P., at 503 m. altitude, 21°00'S and 48°41'W. Temperature ranged from a minimum of 17°C to a maximum of 31°C, with a yearly mean of 24°C and annual mean rainfall of 1320 mm.

The herd was raised on pasture and the lactating cows received one kg of concentrated ration for each three or four kg of milk produced, as well as corn silage *ad libitum* during the dry season.

Statistical analysis

Data were analysed by least-squares and maximum likelihood procedures, proposed by Harvey (1987), to evaluate the SOF effects and estimate the components of variance, using the following model:

$$Y_{ijkl} = \mu + a_i + B_j + (aB)_{ij} + F_k + \varepsilon_{ijkl}$$

where: Y_{ijkl} is the response variable (MY, FY and F%); μ is the overall mean; a_i is the random effect of SOF; B_j is the fixed effect of SOC; $(aB)_{ij}$ is the SOF x SOC interaction; F_k is a set of fixed effects: season, year and regression of age at calving, and ε_{ijkl} is a random error, normal independent distribution assumed, $(0, \sigma_e^2)$.

RESULTS AND DISCUSSION

The overall means and standard errors of MY, FY and F% were 2,728.8 ± 55.40 kg, 117.3 ± 2.72 kg and 4.21 ± 0.03, respectively. Mean lactation length and age at parturition were 274.2 ± 5.82 days and 57.5 ± 7.2 months, respectively.

Table I shows the analysis of variance and estimated sire of fetus effects on the traits studied.

Table I - Least-square analysis of variance of milk yield (MY), fat yield (FY), and fat percentage (F%).

Sources of variation	Degrees of freedon	Mean squares		
		MY	FY	F% (x 10^{-2})
SOF	67	733735	1403**	89**
SOC	81	2887535**	4384**	44**
Season of calving	1	611605	1278	03
Year of calving	7	1757440**	5263**	68**
SOF x SOC	850	569992	937	03
Age of cow (R)				
Linear age	1	269484120**	39065**	65**
Quadratic age	1	4350797**	5371**	32**
Error	1273	595856	941	29

* - $P \leq 0.05$; ** - $P \leq 0.01$

The contribution of SOF, expressed as a percentage of total variance for MY was low (0.81%) and non significant and greater and significant for FY and F% (1.67 and 6.43%, respectively). For lactation length the contribution of SOF was 2.48%, which is significant ($P \leq 0.01$). These results suggest that the inclusion of SOF in mathematical models might increase the repeatability of sire proofs and improve the rate of genetic change in breeding programs.

ACNOWLEDGMENTS

We are grateful to the Companhia de Financiamento Mercantil (CFM), São José do Rio Preto, SP, for providing the data. Research and publication supported by FAPESP.

RESUMO

Foram estudadas 2287 informações da produção de leite (PLEI), produção de gordura (PGORD) e porcentagem de gordura (%GORD) de 618 vacas da raça Pitangueiras (3/8 Zebu, 5/8 Red Poll), filhas de 82 touros (SOC) acasaladas com 68 pais de feto (SOF), para estimação de magnitude dos efeitos do pai do feto sobre as características produtivas. Os dados foram analisados segundo o método dos quadrados mínimos (LSMLMW) proposto por Harvey (User's guide for LSMLMW, Wooster, Ohio State University, 1987). As estimativas, expressas como porcentagem da variância total, foram 0,81, 1,67 e 6,43 para PLEI, PGORD e %GORD, respectivamente. Os resultados sugerem que a inclusão dos efeitos do SOF nas análises possa melhorar os resultados dos testes de progênie e as estimativas do valor genético dos touros testados.

REFERENCES

Balaine, D.S. and Touchberry, R.W. (1980). Effects of previous service sire and previous service sire x breed interaction of cow on percent milk component traits and days open. *J. Anim. Sci. 51* (Suppl. 1): 63-96.

Bolander, F.F., Ulberg, L.C. and Fellows, R.E. (1976). Circulating placental lactogen levels in dairy and beef cattle. *Endocrinology 99*: 1273.

Eley, R.M., Thatcher, W.W., Bazer, F.W., Wilcox, C.J., Becker, B., Head, H.H. and Adkinson, R.W. (1978). Development of conceptus in the bovine. *J. Dairy Sci. 61*: 47-73.

Gaines, W.L. (1915). A contribution to the physiology of lactation. *Am. J. Physiol. 38*: 285.

Harvey, W.R. (1987). *User's guide for LSMLMW (Mixed Model Least-Square and Maximum Likelihood Computer Program)*. Ohio State University, Wooster, pp. 59.

Hayes, J.F., Mangurkar, B.R. and Cue, R.I. (1984). Effect of sire of foetus on production traits. *J. Dairy Sci. 67* (Suppl. 1): 246.

Lôbo, R.B., Reis, J.C. and Duarte, F.A.M. (1990). Efeito do pai do bezerro sobre as características de produção na lactação subseqüente de vacas da raça Pitangueiras. In: *XXXVI Congresso Nacional de Genética*. Caxambú, M.G., Brazil, pp. 80.

Moya, J. (1985). Sire of fetus effects and environmental correlations for dairy cattle production and reproduction. Doctoral Thesis, University of Florida, Florida.

Moya, J., Wilcox, C.J., Littell, R.C., Thatcher, W.W. and Martin, F.G. (1991). Variation associated with interactions of sire of fetus, sire of cow, and herd-year-season in Jersey production and reproduction. *Rev. Bras. Genet. 14*: 381-392.

Skejervold, H. and Fimland, E. (1975). Evidence for a possible influence of the fetus on the milk yield of the dam. *Z. Tierzuchtg. Zuchtsbiol. 92*: 245-251.

Thatcher, W.W., Wilcox, C.J., Collier, R.J. and Head, H.H. (1979). Effects of service sire on the performance of the cow after calving. *Proceedings of the 16th Annual Florida Dairy Production Conference*. University of Florida, Gainesville.

Wilcox, C.J. (1980). Conceptus-maternal interactions: introduction. *J. Dairy Sci. 63*: 1481-1482.

(Received June 3, 1992)